

What is claimed is:

1. A discharge cell of a surface discharge type plasma display panel, comprising:
a cavity bounded by a pair of opposing and spaced sidewalls of respective barriers, formed on a first substrate, extending commonly with the pair of sidewalls in a first direction, said barriers having respective flat top portions having a width not less than 7.5 μ m in the second direction, and said barriers have respective height differences between each other of not more than 20 μ m;
an address electrode on the first substrate and extending in the first direction;
a pair of display electrodes on a surface of a second substrate, covered by an insulating layer and positioned in opposed relationship with the address electrode, the pair of display electrodes extending in a second direction, transversely to and crossing the barriers and the cavity therebetween, and defining the discharge cell; and
a phosphor layer within the cavity on one of the first and second substrates, the phosphor layer having a thickness in a range of from 10 μ m to 50 μ m.
2. A discharge cell as recited in claim 1, wherein the top portions have a width not less than 15.0 μ m in the second direction.
3. A discharge cell as recited in claim 1, wherein the phosphor layer is formed on the first substrate, aligned within the cavity, and covers the entire surface of the cavity including sidewalls of the pair of barriers and thereby to constitute a discharge cell of a reflecting type plasma display panel.
4. A discharge cell as recited in claim 1, wherein the pair of display electrodes has a discharge gap of a first width at a central portion of a unit luminescent area and a gap of a second, greater width, at both end portions of the unit luminescent area.
5. A discharge cell as recited in claim 1, wherein a top portion of each barrier is of a dark color.
6. A discharge cell as recited in claim 3, wherein a top portion of each barrier is of a dark color.

7. A discharge cell as recited in claim 1, wherein a width of each cell, in the second direction, is approximately one-third a length thereof, in the first direction.

8. A discharge cell as recited in claim 1, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction and the pair of spaced barriers, the pair of metal conductors having a combined width in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

9. A plasma display panel of a surface discharge type and having an array, of plural columns in the first direction and plural rows in a second direction transverse to the first direction, of plural image elements, each image element comprising a respective set of unit luminescent areas, each set of unit luminescent areas comprising a set of discharge cells, wherein each discharge cell comprises:

- a cavity bounded by respective opposing and spaced sidewalls of a pair of barriers formed on a first substrate, said barriers having respective flat top portions having a width of not less than $7.5\text{ }\mu\text{m}$ in the second direction and respective height differences between each other of not more than $20\text{ }\mu\text{m}$;

- an address electrode on the first substrate, extending in the first direction,

- a pair of display electrodes formed on a surface of a second substrate covered by an insulating layer and positioned in opposed relationship with the address electrodes, the pair of display electrodes extending in a second direction and defining the discharge cell, and

- a phosphor layer disposed within the cavity on the first substrate; and

- each set of discharge cells comprises a common number of discharge cells in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of the discharge cells being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of discharge cells, aligned in the columns of the array.

10. A plasma display panel as recited in claim 9, wherein the top portions have a width not less than $15.0\text{ }\mu\text{m}$ in the second direction.

11. A plasma display panel as recited in claim 9, wherein:

each set of discharge cells has respective, first and second combined dimensions in the first and second directions which are substantially the same.

12. A plasma display panel as recited in claim 9, wherein:
each set of discharge cells comprises plural cells having plural, respective and different color phosphor layers, each of which layers having a thickness in a range of from 10 μm to 50 μm .

13. A plasma display panel as recited in claim 9, wherein:
the plural cells of each set are of a common width in the second direction.

14. A plasma display panel as recited in claim 9, wherein:
the plural cells of each set are of respective, different widths in the second direction.

15. A plasma display panel as recited in claim 9 wherein, in each discharge cell, the phosphor layer covers the respective, opposing sidewalls of the pair of barriers.

16. A plasma display panel as recited in claim 9 wherein, in each discharge cell, the phosphor layer is formed on the first substrate, aligned within the cavity, and covers the address electrode and extends to the respective, opposing sidewalls of the pair of barriers, said phosphor layer having a thickness in a range of from 10 μm to 50 μm .

17. A plasma display panel recited in claim 9, wherein each of the pair of display electrodes of each discharge cell comprises a transparent conductor and a respective metal conductor extending therewith in the second direction, and the pair thereof provides a predetermined discharge gap at a central portion of the cell.

18. A plasma display panel as recited in claim 9 wherein, in each discharge cell, the phosphor layer is formed within the cavity and extends to the respective, opposing sidewalls of the barriers and a top portion of each of the barriers has a dark color.

19. A plasma display panel as recited in claim 9, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction and the pair of spaced barriers, the pair of metal conductors having a combined width

in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

20. A plasma display panel of a surface discharge type and having an array of plural image elements, arranged in plural columns in a first direction and plural rows in a second direction, transverse to the first direction, wherein each image element comprises a respective set of unit luminescent areas:

each unit luminescent area comprises:

a cavity bounded by respective opposing and spaced sidewalls of barriers formed on a first substrate and extending in the first direction, said barriers having respective flat top portions of a width not less than $7.5\mu\text{m}$ in the second direction, and respective height differences between each other of not more than $20\mu\text{m}$,

an address electrode on the first substrate extending in the first direction,

a pair of display electrodes formed on a second substrate, covered by a dielectric layer and arranged to constitute a corresponding row of the array in opposed relationship with the cavity, and

a phosphor layer disposed on an inside surface of the cavity on the first substrate with a thickness in a range of $10\mu\text{m}$ - $50\mu\text{m}$; and

each set of unit luminescent areas comprises a common number of unit luminescent areas in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of unit luminescent areas being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of unit luminescent areas, aligned in the columns of the array.

21. A plasma display panel as recited in claim 20, wherein the top portions have a width not less than $15.0\mu\text{m}$ in the second direction.

22. A discharge cell of a surface discharge type plasma display panel, comprising:
a cavity bounded by respective opposing and spaced sidewalls of a pair of barriers superposed on a first substrate, the cavity extending commonly with the pair of barriers in a first direction, said barriers having respective flat top portions of a width not less than $7.5\mu\text{m}$ in the second direction and respective height differences between each other of not more than $20\mu\text{m}$;
an address electrode superposed on the first substrate, adjacent a bottom of the cavity and extending in the first direction;

a pair of display electrodes superposed on a surface of a second substrate, covered by an insulating layer and positioned in opposed relationship with respect to the address electrode, the pair of display electrodes extending in a second direction, transversely to and crossing the barriers and the cavity therebetween, and defining the discharge cell; and

a phosphor layer disposed within the cavity and superposed on one of the first and second substrates, the phosphor layer having a thickness in a range of from 10 μm to 50 μm .

23. A discharge cell as recited in claim 22, wherein the top portions have a width not less than 15.0 μm in the second direction.

24. A discharge cell as recited in claim 22, wherein the phosphor layer is superposed on and covers the address electrode and exposed portions of the first substrate between the spaced and opposing sidewalls and substantially the entire respective surfaces of the spaced and opposing sidewalls of the pair of barriers.

25. A discharge cell as recited in claim 22, wherein the pair of display electrodes has a discharge gap of a first width at a central portion of a discharge cell and a gap of a second, greater width, at both end portions of the discharge cell.

26. A discharge cell as recited in claim 22, wherein a top portion of each barrier is of a dark color.

27. A discharge cell as recited in claim 25, wherein a top portion of each barrier is of a dark color.

28. A discharge cell as recited in claim 22, wherein a width of each cell, in the second direction, is approximately one-third a length thereof, in the first direction.

29. A discharge cell as recited in claim 22, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction and the pair of spaced barriers, the pair of metal conductors having a combined width in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

30. A plasma display panel of a surface discharge type and having an array, of plural columns in the first direction and plural rows in a second direction transverse to the first direction, of plural image elements, each image element comprising a respective set of unit luminescent areas, each set of unit luminescent areas comprising a set of discharge cells, wherein each discharge cell comprises:

a cavity bounded by respective opposing and spaced sidewalls of a pair of parallel barriers superposed on a first substrate, the cavity extending commonly with the pair of barriers in a first direction, said barriers having respective flat top portions of a width not less than $7.5\text{ }\mu\text{m}$ in the second direction and respective height differences between each other of not more than $20\text{ }\mu\text{m}$,

an address electrode superposed on the first substrate, adjacent a bottom of the cavity and extending in the first direction,

a pair of display electrodes superposed on a second substrate covered by an insulating layer and positioned in opposed relationship with respect to the address electrode, the pair of display electrodes extending in a second direction, transversely to and crossing the pair of barriers and the cavity therebetween, and defining the discharge cell, and

a phosphor layer disposed within the cavity and superposed on and covering the address electrode and the opposed and spaced sidewalls; and

each set of discharge cells comprises a common number of discharge cells in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of the discharge cells being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of discharge cells, aligned in the columns of the array.

31. A plasma display panel as recited in claim 30, wherein the top portions have a width not less than $15.0\text{ }\mu\text{m}$ in the second direction.

32. A plasma display panel as recited in claim 30, wherein:
each set of discharge cells has respective, first and second combined dimensions in the first and second directions which are substantially the same.

33. A plasma display panel as recited in claim 30, wherein:

each set of discharge cells comprises plural cells having plural, respective and different color phosphor layers, each of which layers having a thickness in a range of from 10 μm to 50 μm .

34. A plasma display panel as recited in claim 30, wherein:
the plural cells of each set are of a common width in the second direction.

35. A plasma display panel as recited in claim 30 wherein, in each discharge cell, the phosphor layer covers the respective, opposing sidewalls of the pair of barriers.

36. A plasma display panel as recited in claim 30, wherein said phosphor layer has a thickness in a range of from 10 μm to 50 μm .

37. A plasma display panel recited in claim 30, wherein each of the pair of display electrodes of each discharge cell comprises a transparent conductor and a respective metal conductor extending therewith in the second direction, and the pair thereof provides a predetermined discharge gap at a central portion of the cell.

38. A plasma display panel as recited in claim 30 wherein, in each discharge cell, the phosphor layer is formed within the cavity and extends to the respective, opposing sidewalls of the barriers and a top portion of each of the barriers has a dark color.

39. A plasma display panel as recited in claim 30, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction and the pair of spaced barriers, the pair of metal conductors having a combined width in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

40. A plasma display panel of a surface discharge type and having first and second substrates and an array of plural image elements therebetween, arranged in plural columns in a first direction and plural rows in a second direction, transverse to the first direction, wherein:
each image element comprises a respective set of unit luminescent areas and each unit luminescent area comprises:

a cavity, bounded by respective opposing and spaced sidewalls of a pair of spaced barriers superposed on the first substrate and extending in the first direction, said barriers having respective flat top portions of a width not less than 7.5 μ m in the second direction and respective height differences between each other of not more than 20 μ m,

an address electrode superposed on the first substrate, adjacent a bottom of the cavity and extending in the first direction,

a pair of display electrodes superposed on the second substrate, covered by a dielectric layer and arranged to constitute a corresponding row of the array in opposed relationship with the cavity, and

a phosphor layer within the cavity of a thickness in a range of 10 μ m-50 μ m; and

each set of unit luminescent areas comprises a common number of unit luminescent areas in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of unit luminescent areas being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of unit luminescent areas, aligned in the columns of the array.

41. A plasma display panel as recited in claim 40, wherein the top portions have a width not less than 15.0 μ m in the second direction.

42. A discharge cell of a surface discharge type plasma display panel, comprising:
a cavity bounded at least in part by respective cavity sidewalls supported by a first substrate, said cavity sidewalls having respective flat top portions of a width not less than 7.5 μ m in the second direction and respective height differences between each other of not more than 20 μ m;

an address electrode supported by the first substrate, aligned with the cavity and extending in a first direction;

a pair of display electrodes supported by a second substrate, covered by an insulating layer and positioned in opposed, spaced relationship with respect to a portion of the aligned address electrode and defining the discharge cell therebetween, said display electrode extending in a second direction; and

a phosphor layer disposed within the cavity and supported on the cavity sidewall and the portion of the aligned address electrode.

43. A discharge cell as recited in claim 42, wherein the top portions have a width not less than 15.0 μm in the second direction.

44. A discharge cell as recited in claim 42, wherein the phosphor layer has a thickness in a range of from 10 μm to 50 μm .

45. A discharge cell as recited in claim 44, wherein a top portion of each cavity sidewall is of a dark color.

46. A discharge cell as recited in claim 42, wherein the pair of display electrodes has a discharge gap of a first width at a central portion of a discharge cell and a gap of a second, greater width, at both end portions of the discharge cell.

47. A discharge cell as recited in claim 42, wherein the address electrode is disposed adjacent a bottom of the cavity.

48. A discharge cell as recited in claim 42, wherein a width of each discharge cell, in the second direction, is approximately one-third a length thereof, in the first direction.

49. A discharge cell as recited in claim 42, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction, the pair of metal conductors having a combined width in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

50. A plasma display panel of a surface discharge type and having an array, of plural columns in the first direction and plural rows in a second direction transverse to the first direction, of plural image elements, each image element comprising a respective set of unit luminescent areas, each set of unit luminescent areas comprising a set of discharge cells, wherein each discharge cell comprises:

a cavity bounded at least in part by a respective cavity sidewall supported by a back substrate, said cavity sidewalls having a flat top portion of a width not less than 7.5 μm in the second direction and respective height differences between each other of not more than 20 μm ;

an address electrode supported by the first substrate, aligned with the cavity and extending in a first direction;

a pair of display electrodes supported by a front substrate, covered by an insulating layer and positioned in opposed, spaced relationship with respect to, and extending in a second direction and crossing, a portion of the aligned address electrode and defining the discharge cell therebetween;

a phosphor layer disposed within the cavity and supported on the cavity sidewall and the portion of the aligned address electrode; and

each set of discharge cells comprises a common number of discharge cells in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of the discharge cells being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of discharge cells, aligned in the columns of the array.

51. A plasma display panel as recited in claim 49, wherein the top portions have a width not less than 15.0 μm in the second direction.

52. A plasma display panel as recited in claim 50, wherein:
each set of discharge cells has respective, first and second combined dimensions in the first and second directions which are substantially the same.

53. A plasma display panel as recited in claim 50, wherein:
each set of discharge cells comprises plural cells having plural, respective and different color phosphor layers, each of which layers having a thickness in a range of from 10 μm to 50 μm .

54. A plasma display panel as recited in claim 50, wherein:
the plural cells of each set are of a common width in the second direction.

55. A plasma display panel as recited in claim 50 wherein, in each discharge cell, the phosphor layer covers the respective, opposing sidewalls of the pair of barriers.

56. A plasma display panel as recited in claim 50 wherein, in each discharge cell, the phosphor layer covers the address electrode and has a thickness in a range of from 10 μm to 50 μm .

57. A plasma display panel as recited in claim 50 wherein, in each discharge cell, a top portion of each cavity sidewall has a dark color.

58. A plasma display panel recited in claim 50, wherein each of the pair of display electrodes of each discharge cell comprises a transparent conductor and a respective metal conductor extending therewith in the second direction, and the pair thereof provides a predetermined discharge gap at a central portion of the discharge cell.

59. A plasma display panel as recited in claim 50, wherein each of the pair of display electrodes comprises a metal conductor extending in the second direction, transverse to the first direction, the pair of metal conductors having a combined width in the first direction which is limited so as not to block more than 21% of light emitted from the discharge cell.

60. A plasma display panel of a surface discharge type and having front and back substrates and an array of plural image elements therebetween, arranged in plural columns in a first direction and plural rows in a second direction, transverse to the first direction, wherein:

each image element comprises a respective set of unit luminescent areas and each unit luminescent area comprises:

a cavity, bounded by respective cavity sidewalls, supported by the back substrate,

an address electrode supported by the back substrate, aligned with the cavity and extending in the first direction,

a pair of display electrodes supported by the front substrate, covered by a dielectric layer and arranged to constitute a corresponding row of the array in opposed relationship with the cavity, and

a phosphor layer within the cavity, supported by the back substrate, and having a thickness in a range of 10 μm -50 μm ;

each set of unit luminescent areas comprises a common number of unit luminescent areas in successively spaced adjacent positions in the second direction, the respective phosphor layers of each set of unit luminescent areas being in a common sequence of respective, different colors, and the plural rows of the array having respective, common numbers of sets of unit luminescent areas, aligned in the columns of the array;

each of said sidewalls has a flat top portion of a width not less than 7.5 μm in the second direction; and

said sidewalls have respective height differences between each other of not more than 20 μm .

61. A plasma display panel as recited in claim 60, wherein the top portions have a width not less than 15.0 μm in the second direction.

62. A surface discharge type plasma display panel, comprising:
front and rear substrates in opposing, spaced relationship;
discharge spaces defined by surfaces of respective sidewalls supported by the rear substrate the discharge spaces extending in parallel spaced relationship in first and second transverse directions on the rear substrate, said sidewalls having a flat top portion of a width not less than 7.5 μm and respective height differences between each other of not more than 20 μm ;
respective phosphor layers covering respective bottom and sidewall surfaces of the discharge spaces and supported by the rear substrate; and
address electrodes corresponding to respective phosphor layers and supported on the rear substrate, portions of each address electrode underlying respective bottoms of the discharge spaces being aligned in a common one of the first and second transverse directions.

63. A surface discharge type as recited in claim 62, further comprising:
a dielectric layer formed on the rear substrate; and
barriers formed on the dielectric layer defining the discharge spaces.

64. A surface discharge type as recited in claim 62, wherein the phosphor layer has a thickness in a range of from 10 μm to 50 μm .

65. A surface discharge type as recited in claim 62, wherein the address electrodes are formed on the underlying dielectric layer.

66. The plasma display panel as recited in claim 62, further comprising barriers formed on the rear substrate and defining the discharge spaces.

67. A surface discharge type plasma display panel, comprising:
a first substrate with display electrode pairs extending in a first direction and defining display lines;

a second substrate with address electrodes extending in a second direction, traverse to said first direction of said display lines;

a gas discharge space provided between said first and second substrates; and

barriers separating said gas discharge space into a plurality of discharge cells on each display line, at an array pitch of the address electrodes, each said discharge cell being defined at a portion where a respective said display electrode pair and a respective said address electrode cross each other, said barriers being formed on said second substrate with a height substantially corresponding to a gap length of said gas discharge space and each of said barriers having a flat top portion of a width not less than 7.5 μm in the first direction and a bottom portion of a width wider than a width of said top portion.

68. A surface discharge type as recited in claim 67, wherein the top portions have a width not less than 15.0 μm in the second direction.

69. A surface discharge type plasma display panel as recited in claim 67, further comprising a phosphor layer supported on a side wall of said respective barriers.

70. A discharge cell of a surface discharge type plasma display panel, comprising:
a cavity bounded at least in part by a cavity sidewall supported by a back substrate;
an address electrode supported by the back substrate, aligned with the cavity and extending in a first direction;

a pair of display electrodes supported by a front substrate, covered by an insulating layer and positioned in an opposed, spaced relationship with respect to a portion of the aligned address electrode and defining the discharge cell therebetween, said pair of display electrodes having a pair of projection portions of a transparent conductor forming a discharge gap of a first width at a selected portion of the discharge cell and a pair of metal layer strips forming a gap of a second, greater width at opposite end portions of the discharge cell and extending in a second direction perpendicular to the first direction; and

a phosphor layer disposed within the cavity and supported on the cavity sidewall and on said portion of the aligned address electrode, the phosphor layer having a thickness in a range of from 10 μm to 50 μm , wherein each of said sidewalls has a flat top portion of a width not less than 7.5 μm and a bottom portion of a width wider than the top portion.

71. A discharge cell as recited in claim 70, wherein the top portions have a width not less than 15.0 μm in the second direction.